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By: Temi L. Linder

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

In re Appellant:

GLOVER, JOHN N.

Filed: May 27, 1999

Application No.: 09/320,950

For: FILTERING MEDIUM AND
METHOD FOR CONTACTING
SOLIDS CONTAINING FEEDS
FOR CHEMICAL REACTORS

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Art Unit: 1723

Primary Examiner: David L. Sorkin

Docket No.: 20781.004

AMENDED APPEAL BRIEF
(under 37 C.F.R. § 41.37)

This is an appeal from the final rejection of Claims 59, 61 – 67, and 69 – 85 in the above referenced patent application. The Final Office Action was dated June 7, 2005. A Notice of Panel Decision from Pre-Appeal Brief Review was mailed to Appellant on January 12, 2006, setting forth that the application remains under appeal because there is at least one actual issue for appeal.

Applicant's original Appeal Brief was filed on March 13, 2006. A Notification of Non-Compliant Appeal Brief was mailed on March 29, 2006, and this Amended Appeal Brief is being filed on May 26, 2006, in response thereto, along with the appropriate extension of time fees.

I. REAL PARTIES IN INTEREST

The inventor, John N. Glover, and the assignee, Crystaphase International, Inc., are the only real parties in interest with respect to the captioned patent application.

II. RELATED APPEALS AND INTERFERENCES

There are none.

III. STATUS OF CLAIMS

A. Status of the Claims

1. Claims cancelled: 1-58, 60 and 68.
2. Claims withdrawn (but not cancelled): None.
3. Claims pending: 59, 61-67 and 69-85.
4. Claims allowed: None.
5. Claims rejected: 59, 61-67 and 69-85.

B. Claims on Appeal

Claims 59, 61-67 and 69-85 are presently on appeal.

IV. STATUS OF AMENDMENTS

Claims 59, 61-67 and 69-85 were finally rejected in an Office Action dated June 07, 2005. Claims 59, 61-67 and 69-81 were rejected under 35 U.S.C. §103(a) for obviousness over Kramer (US 4,615,796) (hereinafter "Kramer") in view of "CE Refresher: Catalyst Engineering, Part 2" by John Fulton (hereinafter "Fulton"). Claims 82-85 were rejected under 35 U.S.C. §112 for failing to comply with the written description requirement.

Appellant filed an Amendment and Response Subsequent to Final Rejection on August 8, 2005. An Advisory Action was mailed to Appellant on August 29, 2005, advising Appellant that the Amendment and Response did not place the application in condition for allowance.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

Claims 59, 67 and 78 are independent claims. Claims 61-66, 79 and 82-83 are ultimately dependent upon Claim 59. Claims 69-77, 80 and 84-85 are ultimately dependent upon Claim 67. Claim 81 is dependent upon Claim 78. A summary of the subject matter of the most relevant independent and dependent claims currently on appeal is presented as follows:

Claim 59

The first independent claim, Claim 59, features a method of fluid distribution in a chemical reactor 22 comprising the steps of:

(A.) providing a layer 66, 68, 70 (FIG. 2) of a plurality of ceramic filter units 15 (FIGS. 4-16), at least some of the ceramic filter units 15 including a body having a substantially annular outer peripheral shape (FIGS 4-5), a central opening 108 extending through the body, and at least three elliptical openings 89 extending through the body and positioned between the central opening 108 and an outer periphery of the body so that a combination of the central opening 108 and the at least three elliptical openings 89 define a plurality of fluid flow passageways 87, 88, 89, 108 (FIGS. 4, 5, 14) extending through the at least some of the plurality of ceramic filter units 15;

(B.) contacting an organic-based feed stream 51 (FIG. 2) with the layer 66, 68, 70 of the plurality of ceramic filter units 15; and

(C.) subdividing the organic-based feed stream 51 into a plurality of smaller fluid streams by passing the organic-based feed stream 51 through the plurality of fluid flow passageways 87, 88, 89, 108 (FIGS. 4, 5, 14) prior to the organic-based feed stream 51 contacting a catalyst bed in the chemical reactor 22.

Claim 67

The second independent claim, Claim 67, features a method of fluid distribution in a chemical reactor 22 comprising the steps of:

(A.) providing a layer 66, 68, 70 (FIG. 2) of a plurality of ceramic filter units 15 (FIGS. 4-16), at least some of the ceramic filter units 15 including a body having a substantially polygonal outer peripheral shape (FIGS 4-5), a central opening 108 extending through the body, and at least three elliptical openings 89 extending through the body and positioned between the central opening 108 and an outer periphery of the body so that a combination of the central opening 108 and the at least three elliptical openings 89 define a plurality of fluid flow passageways 87, 88, 89, 108 (FIGS. 4, 5, 14) extending through the at least some of the plurality of ceramic filter units 15;

(B.) contacting an organic-based feed stream 51 (FIG. 2) with the layer 66, 68, 70 of the plurality of ceramic filter units 15; and

(C.) subdividing the organic-based feed stream 51 into a plurality of smaller fluid streams by passing the organic-based feed stream 51 through at least some of the plurality of fluid flow passageways 87, 88, 89, 108 (FIGS. 4, 5, 14) prior to the organic-based feed stream 51 contacting a catalyst bed in the chemical reactor 22.

Claim 78

The third independent claim, claim 78, features a method of fluid distribution in a chemical reactor comprising the steps of:

(A.) providing a layer 66, 68, 70 (FIG. 2) of a plurality of ceramic filter units 15 (FIGS. 4-16), at least some of the ceramic filter units 15 including a body, a central opening 108 extending through the body, and at least three elliptical openings 89 also extending through the body and positioned between the central opening 108 and an outer periphery of the body so that a combination of the central opening 108 and the at least three elliptical openings 89 define a plurality of fluid flow passageways 87, 88, 89, 108 (FIGS. 4, 5, 14) extending through each of the plurality of ceramic filter units 15;

(B.) contacting an organic-based feed stream 51 (FIG. 2) with the layer 66, 68, 70 of the plurality of ceramic filter units 15; and

(C.) subdividing the organic-based feed stream 51 into a plurality of smaller fluid streams by passing the organic-based feed stream 51 through the at least some of the plurality of fluid flow passageways 87, 88, 89, 108 prior to the organic-based feed stream 51 contacting a catalyst bed in the chemical reactor 22.

Claim 82

Dependent claim 82 features the method of claim 64, wherein the fluted outer peripheral surface of the at least one of the plurality of ceramic filter units has sharp edges.

Claim 83

Dependent claim 83 features the method of claim 65, wherein at least one of the recessed notches of the outer periphery has sharp edges.

Claim 84

Dependent claim 84 features the method of claim 70, wherein at least one of the notches recessed from the outer periphery has sharp edges.

Claim 85

Dependent claim 85 features the method of claim 76, wherein at least one of the recessed notches on the outer periphery has sharp edges.

VI. GROUND OF REJECTION TO BE REVIEWED ON APPEAL

1. Whether Claims 59, 61-67 and 69-81 are unpatentable under 35 U.S.C. §103(a) for obviousness over Kramer in view of Fulton.

2. Whether Claims 82-85 are unpatentable under 35 U.S.C. §112 for failing to comply with the written description requirement.

VII. ARGUMENT

1. Rejection Under 35 U.S.C. § 103(a) Over Kramer In View Of Fulton is Improper.

Independent Claims 59, 67, and 78, and the claims dependent therefrom, are not obvious over Kramer in view of Fulton. To establish a *prima facie* case of obviousness, three criteria must be met. First, the prior art reference (or references when combined) must teach or suggest all the claim limitations. Second, there must be a reasonable expectation of success. Finally, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art and not based upon Appellant's disclosure. *In re Vaeck*, 947 F.2d 488 (Fed. Cir. 1991).

Appellant respectfully submits that none of the three above-described criteria have been met in the present case, and in support provides the following remarks.

The References Do Not Teach or Suggest All Claim Limitations

Kramer in combination with Fulton does not teach or suggest all of the claim limitations of Claims 59, 67 and 78, which is a requirement to establish a *prima facie* case of obviousness.

Claims 59, 67 and 78 each relate to a method of fluid distribution. Appellant respectfully submits that neither Fulton nor Kramer discloses or suggests the element of fluid distribution. Kramer discloses a method of filtering. Fluid distribution is not the same as, nor equivalent to, or inherent in, filtering. Fluid distribution involves resubdividing, a plurality of times, an incoming fluid stream into multiple smaller fluid streams so that the incoming stream is

distributed, i.e., spread across, the fluid entry cross section of a reactor bed in a uniform manner. (see Appellant's Application, ¶ [0055]). This uniform fluid distribution occurs in addition to, and not because of, any filtration that may also be occurring.

Kramer does not teach or suggest that its guard bed particles have any fluid distribution properties. Kramer only teaches that the particles can be used for traditional filtration purposes, i.e., removing suspended solids of greater than 10 microns in diameter, preferably iron sulfide, from mixed phase gas-liquid-solid streams (see Kramer, col. 3, lines 8 – 15). Kramer is tailored to correcting a specific problem in the petroleum processing industry, namely filtration-based removal of solid materials. This filtration process would not necessarily result in fluid distribution, and in particular would not produce uniform fluid distribution across the cross section of the bed as achieved by the present invention. Solids filtration is clearly distinguishable from, and does not make obvious, gas and liquid fluid distribution as claimed in the present invention.

Claims 59, 67, and 78 each also describe and claim the feature of subdividing an organic-based feed stream into a plurality of smaller fluid streams by passing the organic-based feed stream through one or more of a plurality of fluid flow passageways. An embodiment of Appellant's invention involves the use of ceramic filter units with openings, wherein the particular fluid in the reactor not only passes around the ceramic filter units, but also through at least some of the units via the plurality of fluid flow passageways created by the openings in the units. In particular, the passageways comprise three or more passages surrounding a central passage.

Appellant respectfully submits that this feature is not disclosed or suggested in Kramer or Fulton. Kramer sets forth that alternative shaped guard bed particles can be used. (see Kramer, col. 4, lines 1 – 4). However, every example in Kramer utilizes a sphere or a cylinder, with the sphere being the particle shape of choice. There is no teaching or suggestion that ceramic filter units with openings, and specifically with three or more passages surrounding a central passage, could be utilized, or that such a configuration would be beneficial. Without this specific arrangements of openings claimed in the present invention, the particles disclosed in Kramer would not provide the subdivided flow required to uniformly distribute the organic-based feed stream across a catalyst bed to prevent channeling and other deleterious consequences.

Claims 59, 67, and 78 each also describe and claim the use of elliptical openings. Appellant respectfully submits that neither Kramer nor Fulton teaches the use of elliptical openings, or recognizes the advantages that this shape of opening provides. The Primary Examiner contends that Fulton teaches circular openings, and that the "broadest reasonable definition of an ellipse includes a circle" (Final Office Action, p. 3, lines 8-9); however, Appellant is not claiming "circular openings," but only "elliptical" openings. Furthermore, Appellant's elliptical shaped openings provide improved fluid distribution properties when compared to circular openings (see No Reasonable Expectation of Success section below), which indicates that elliptical openings and circular openings are indeed distinguishable from each other, both in shape and results achieved. Also, the spaces around and between the particles in Kramer would eventually become plugged with solids, while the elliptical openings in the ceramic units of the present invention would continue to allow fluid flow through the ceramic units, which results in uniform fluid distribution throughout the packed bed.

No Reasonable Expectation of Success

There must be a reasonable expectation of success in order for the prior art to be modified or combined to reject claims as *prima facie* obvious. See *In re Merck & Co., Inc.*, 231 U.S.P.Q. 375 (Fed. Cir. 1986). Neither Kramer nor Fulton indicates or suggests that Appellant's claimed invention would have a reasonable expectation of success.

To the contrary, Appellant's use of ceramic units with elliptical openings unexpectedly results in advantageous results when compared to prior art materials. To support this assertion, Appellant submitted a declaration from the inventor John N. Glover in the Amendment and Response to Office Action filed November 5, 2003. (See Section IX – Evidence Appendix). This declaration sets forth the following pertinent information:

- (a) Appellant performed experiments comparing the ceramic filter units of the present invention with prior art ceramic filter units that are structurally similar to guard bed particles/catalyst pellets such as those found in Fulton and Kramer.
- (b) Appellant's use of the ceramic units of the present invention unexpectedly resulted in advantageous fluid distribution properties, such as improved horizontal fluid distribution and significantly decreased pressure drop across a filter bed.
- (c) The use of elliptical openings advantageously provided additional flow control parameters, i.e., the ability to vary the major and minor axes of the elliptical openings, when designing the ceramic units.

- (d) The Assignee of Appellant has enjoyed substantial commercial success from the sale of the ceramic units of the present invention, which should be considered indicative of the fact that the ceramic units have met a long felt, unfilled need in the relevant industry.

No Suggestion or Motivation to Combine References

Finally, there is no suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the references or to combine reference teachings, *assuming arguendo* that the references contain the specific teachings of Appellant's claim limitations directed to fluid distribution and elliptical openings.

"[The] teachings of references can be combined *only* if there is some suggestion or incentive to do so." *See In re Fritch* 23 U.S.P.Q. 2d 1780, 1783 (Fed. Cir. 1992) (emphasis in the original). "The mere fact that the prior art may be modified in the manner suggested by the Primary Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification." *See id* at 1783-84. Further, a person of ordinary skill in the art must have some motivation to combine the reference teachings *in the particular manner claimed*. *See, e.g., In re Kotzab*, 55 U.S.P.Q. 2d 1313, 1317 (Fed. Cir. 2000) (stating that "[p]articular findings must be made as to the reason the skilled artisan, with *no knowledge* of the claimed invention, would have selected these components for combination in the manner claimed." (emphasis added)).

Appellant respectfully submits that one of ordinary skill in the art would not be motivated to combine the teachings of Kramer and Fulton to create Appellant's claimed invention. The Primary Examiner has attempted to piece together Appellant's claimed invention from Kramer and Fulton using a hindsight reconstruction of the prior art, which is impermissible.

For example, Appellant claims a method of flow distribution. The Primary Examiner does not specifically identify the motivation for one skilled in the art to modify the filtration units in Kramer to provide openings that achieve enhanced flow distribution. Flow distribution is an entirely different function from filtration. In fact, one skilled in the art would not seek to add a plurality of openings to the guard bed particles taught by Kramer, because this would diminish the effectiveness of these particles in filtering solid materials. That is, adding openings to the particles would allow more solids to pass through the particles, which is contrary to the intended purpose of the invention.

Further, Appellant claims a central opening in the cylindrical unit, and a plurality of other openings surrounding the central opening. The Primary Examiner does not specifically identify the motivation in either reference for one skilled in the art to combine the references to produce these features. Kramer does not teach these features at all, and merely sets forth the open-ended statement that the "particles can be in other configurations." (Kramer, col. 4, lines 1 – 4). Fulton teaches a unit with openings therein, but only as an example of "the almost limitless varieties possible." (Fulton, p. 97). These types of broad, generalized statements in the references are insufficient to provide specific motivation to one skilled in the art to combine the references. Only improper hindsight reconstruction would lead one to believe otherwise.

Even further, the Appellant claims elliptical-shaped openings. The Primary Examiner does not specifically identify the motivation for one skilled in the art to take the step of making the plurality of surrounding openings elliptical in shape. In fact, the words "ellipse" or "elliptical" are never used, or even suggested, in either reference.

The Primary Examiner has not set forth the *prima facie* elements necessary to show why one with ordinary skill in the art would be motivated to combine the Kramer and Fulton references to provide the missing elements of the current invention.

2. Rejection under 35 U.S.C. §112 is Improper.

The Examiner has rejected claims 82-85 under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement. More specifically, the Examiner considers the language in these claims relating to the outer periphery of the filter unit having "sharp edges" to be new matter. A common feature of the polygonal shaped units and units with fluted surfaces or recessed notches of Appellant's invention is that they each have sharp edges and/or corners on the outer peripheries of the unit surface.

The Examiner indicates that there is "no discussion of the issue of edge sharpness" in the originally filed disclosure. (Final Office Action, p. 2, section 2); Appellant respectfully submits, however, that §112 does not require that the disclosure include a "discussion" of the claimed subject matter. For example, under proper circumstances, the drawings alone may provide a written description of an invention under §112. *See Cooper Cameron v. Kvaerner Oilfield*, 291 F. 3d 1317 (Fed. Cir. 2002). Drawings constitute an adequate description if they describe what is claimed and convey to those of skill in the art that the patentee actually invented what is claimed. *Id.*

FIGS. 5, 6, 7, 8, 9, 10, 11 and 13 of the drawings in Appellant's originally filed disclosure all show embodiments of the filter unit having three or more sides. The sides of each unit connect such that sharp edges and/or corners are formed on the outer periphery of the unit. In

connection therewith, paragraph [0012] of Appellant's published application teaches that the units may have "substantially any polygonal configuration, such as triangles, quadrilaterals and pentagons." Thus, to put it another way, the triangular, quadrilateral, pentagonal, and other similarly shaped figures shown in the aforementioned drawings all, by definition, have three or more sharp corners and/or edges formed on their outer peripheries. The sharp edges and/or corners on the units in the drawings are particularly distinguishable when compared with the units shown in FIGS. 4 and 12 on the same page, which have curved exterior peripheries and no sharp corners/edges. This distinguishing feature is prominently displayed in the drawings, and would be understood by one skilled in the art based solely upon viewing the drawings.

Argument Summary

As to the obviousness rejection made under 35 U.S.C. §103, neither the references alone, or in combination, teach or suggest each and every element of independent claims 59, 67, or 78, or the claims dependent therefrom, which is required to establish a *prima facie* case of obviousness. There is no reasonable expectation of success in combining the references to produce Appellant's claimed invention, which is another requirement to establish a *prima facie* case of obviousness. Lastly, there is no suggestion or motivation to combine reference teachings, *assuming arguendo*, that the references even teach Appellant's claim limitations, as also required to establish a *prima facie* case of obviousness.

As to the written description rejection made under 35 U.S.C. §112, Appellant respectfully submits that the features in claims 82 - 85 are described in the drawings, and are not new matter.

Appellant's drawings describe what is claimed and convey to those skilled in the art that Appellant actually invented what is claimed.

Conclusion

For the foregoing reasons, it is submitted that the Primary Examiner's rejections of claims 59, 61-67 and 69-85 are erroneous, and reversal of the Primary Examiner's decision is respectfully requested.

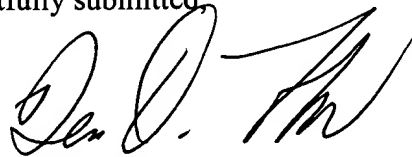
The required fee for submitting a brief in support of appeal was originally submitted on March 13, 2006. A check for \$60.00 for a one month extension of time in connection with this responsive brief to the Notification of Non-Compliant Appeal Brief is submitted herewith.

Please charge any additional required fees and credit any overpayments, to the Deposit Account of Bracewell & Giuliani LLP, Deposit Account No. 50-0259 (attorney docket no. 020781.04).

Respectfully submitted,

Date:

5/30/06



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VIII. CLAIMS APPENDIX

A copy of the claims presented in this appeal is included below.

Claim 59. A method of fluid distribution in a chemical reactor comprising the steps of: providing a layer of a plurality of ceramic filter units, at least some of the ceramic filter units including a body having a substantially annular outer peripheral shape, a central opening extending through the body, and at least three elliptical openings extending through the body and positioned between the central opening and an outer periphery of the body so that a combination of the central opening and the at least three elliptical openings define a plurality of fluid flow passageways extending through the at least some of the plurality of ceramic filter units; contacting an organic-based feed stream with the layer of the plurality of ceramic filter units; and subdividing the organic-based feed stream into a plurality of smaller fluid streams by passing the organic-based feed stream through the plurality of fluid flow passageways prior to the organic-based feed stream contacting a catalyst bed in the chemical reactor.

Claim 61. A method as defined in claim 59, further including the steps of: removing contaminants from a contaminated organic-based feed stream; and providing a decontaminated and uniformly spread organic-based feed stream to a catalyst bed for further processing in the chemical reactor.

Claim 62. A method as defined in claim 59, including the step of packing the ceramic filter units into the chemical reactor with a packing factor of about 200 to 500 ft²/ft³.

Claim 63. A method as defined in claim 59, including the step of packing the ceramic filter units in graduated layers into the chemical reactor with each layer having a different packing factor of about 200 to 500 ft²/ft³.

Claim 64. A method as defined in claim 59, wherein the body of at least one of the plurality of ceramic filter units has a fluted outer peripheral surface.

Claim 65. A method as defined in claim 59, wherein the outer peripheral includes a plurality of recessed notches extending inwardly from the outer periphery towards the medial portion of the ceramic filter unit.

Claim 66. A method as defined in claim 59, wherein the at least three elliptical openings substantially surround the central opening between the central opening and the outer periphery to thereby define a ring around the central opening.

Claim 67. A method of fluid distribution in a chemical reactor comprising the steps of:
providing a layer of a plurality of ceramic filter units, at least some of the ceramic filter units including a body having a substantially polygonal outer peripheral shape, a central opening extending through the body, and at least three elliptical openings extending through the body and positioned between the central opening and an outer periphery of the body so that a combination of the central opening and the at least three elliptical openings define a plurality of fluid flow passageways extending through the at least some of the plurality of ceramic filter units;
contacting an organic-based feed stream with the layer of the plurality of ceramic filter units; and
subdividing the organic-based feed stream into a plurality of smaller fluid streams by passing the organic-based feed stream through at least some of the plurality of fluid flow passageways prior to the organic-based feed stream contacting a catalyst bed in the chemical reactor.

Claim 69. A method as defined in claim 67, further including the steps of: removing contaminants from a contaminated organic-based feed stream; and providing a decontaminated and uniformly spread organic-based feed stream to a catalyst bed for further processing in the chemical reactor.

Claim 70. A method as defined in claim 67, wherein the outer peripheral includes a plurality of notches recessed from the outer peripheral towards the medial portion of the ceramic filter unit.

Claim 71. A method as defined in claim 67, including a step of utilizing ceramic filter units wherein the outer periphery has a polygonal shape with a length of about 1/8 inches to about 3 inches.

Claim 72. A method as defined in claim 67, wherein the body of at least one of the plurality of ceramic filter units has a substantially polygonal shape selected from the group consisting of triangles, quadrilaterals, squares, rectangles, pentagons, hexagons, heptagons, and octagons.

Claim 73. A method as defined in claim 67, wherein the body of at least one of the plurality of ceramic filter units has a square shape with a width of about 1/4 inches to about 3 inches.

Claim 74. A method as defined in claim 67, wherein the body of at least one of the plurality of ceramic filter units has a rectangular shape with a length of about 1/4 inches to about 3 inches and a width of about 1/4 inches to about 3 inches.

Claim 75. A method as defined in claim 67, wherein the body of at least one of the plurality of ceramic filter units has a closed-planed shape with a width of about 1/4 inches to about 3 inches.

Claim 76. A method as defined in claim 67, wherein the outer peripheral includes a plurality of recessed notches extending inwardly from the outer periphery towards the medial portion of the ceramic filter unit.

Claim 77. A method as defined in claim 67, wherein the at least three elliptical openings substantially surround the central opening between the central opening and the outer periphery to thereby define a ring around the central opening.

Claim 78. A method of fluid distribution in a chemical reactor comprising the steps of:
providing a layer of a plurality of ceramic filter units, at least some of the ceramic filter units including a body, a central opening extending through the body, and at least three elliptical openings also extending through the body and positioned between the central opening and an outer periphery of the body so that a combination of the central opening and the at least three elliptical openings define a plurality of fluid flow passageways extending through each of the plurality of ceramic filter units;
contacting an organic-based feed stream with the layer of the plurality of ceramic filter units; and
subdividing the organic-based feed stream into a plurality of smaller fluid streams by passing the organic-based feed stream through the at least some of the plurality of fluid flow passageways prior to the organic-based feed stream contacting a catalyst bed in the chemical reactor.

Claim 79. A method as defined in Claim 59, wherein the central opening is circular.

Claim 80. A method as defined in Claim 67, wherein the central opening is circular.

Claim 81. A method as defined in Claim 78, wherein the central opening is circular.

Claim 82. A method as defined in Claim 64, wherein the fluted outer peripheral surface of the at least one of the plurality of ceramic filter units has sharp edges.

Claim 83. A method as defined in Claim 65, wherein at least one of the recessed notches of the outer periphery has sharp edges.

Claim 84. A method as defined in Claim 70, wherein at least one of the notches recessed from the outer periphery has sharp edges.

Claim 85. A method as defined in Claim 76, wherein at least one of the recessed notches on the outer periphery has sharp edges.

IX. EVIDENCE APPENDIX

This Appendix includes a copy of a declaration submitted by inventor John N. Glover in the Amendment and Response to Office Action filed November 5, 2003.

5. I participated in an experiment in which comparative performance data was obtained for ceramic filter units comparing ceramic units in accordance with the present invention having combinations of elliptical and circular openings, along with flutes, to ceramic units in accordance with prior art units having combinations of circular openings and flutes. Five prior art ceramic units (Products A, B, C, D, and E) were compared to three ceramic units made in accordance with the present invention (Products F, G, and H, as shown in FIG. 4 of the present application).
6. Products A and B were spherical ceramic balls made in accordance with the ceramic units in U.S. Patent No. 4,615,796 issued to Kramer (hereinafter "Kramer"), with Product A having a 6" bed and Product B having a 12" bed.
7. Product C was a 5/8" disc with six circular openings and one central circular opening that is substantially similar to the closest prior art in "CE Refresher: Catalyst Engineering, Part 2" by John Fulton (hereinafter "Fulton") as shown at Fig. 1, third column, fifth row (hereinafter "Fulton Ceramic Unit"). A sample of Product C has been included and is labeled as C. Product C is manufactured by Haldor Topsoe A/S and is commercially available as TK-10. TK-10 has been on the market for approximately seventeen years and is the number one selling ceramic unit. Product C (i.e., TK-10) is the closest commercially available ceramic unit structurally to the Fulton Ceramic Unit. Product D is a 7/8" disc with six circular openings and one central circular opening. Product D is substantially similar to Product C, but with a larger diameter. To the best of my knowledge, the Fulton Ceramic Unit is not commercially available.
8. Product E is a 5/8" ceramic unit with one central circular opening and six flutes. Product E is commercially available as Dypor 607 and is manufactured by Dytech Corporation, Ltd. in Sheffield, England. A sample of Product E has been included and is labeled as E.
9. Product F is a 5/8" ceramic unit with one central circular opening and four surrounding elliptical openings made in accordance with the present invention. A sample of Product F has been included and is labeled as F. Product G is a 7/8" disc with one central circular opening and four surrounding elliptical openings, also made in accordance with the present

invention. Products F and G are commercially available as BG-1000 and are sold by the Assignee of the present invention.

10. Product H is a 7/8" elongated disc with one central circular opening and four surrounding elliptical openings made in accordance with the present invention. Product H is commercially available as BG-1002 and is sold by the Assignee of the present invention. A sample of Product H has been included and is labeled as H. Product H is twice as long as Product G.
11. A test apparatus was constructed using a 12" internal diameter by 18" tall 26 gauge steel cylinder with a collection grid inside the cylinder, as shown in FIG. 1 attached hereto. The collection grid was constructed of 1/2" thick grating on top of a solid plate, which was placed in the bottom of the cylinder as a collector floor, as shown in FIG. 3 attached hereto. The plate was drilled with 253 holes through the cells of the grating, each having a 1/4" diameter. Each one of the holes was centered in the collection grid with 0.65" centers, which created collection squares or cells, as shown in FIG. 3 attached hereto. The collection grid was secured to the floor using a silicon sealer.
12. Clear plastic tubes were pressed into each hole from below until the tubes extended approximately 1/16" above the top of the plate. A watertight seal was formed around each of the tubes. A clear plastic baffle was drilled to match the holes in the collector floor and installed 1/2" above the end of the 8" plastic tubes, as shown in FIG. 2 attached hereto. Both the collector and the lower portion of the plastic tubes were marked to accurately identify each individual tube during experimenting.
13. A single flow-regulated water inlet was installed so that the inlet could be accurately centered and placed six inches above the top of the bed to be tested. A six inch headspace is commonly used in trickle bed reactors into which the present invention is commonly installed. The water flow rate used in the experiments was one liter per minute.
14. The flow device and the steel cylinder/collector assembly were mounted on a seven foot tall stand. The fluid flow collection was at eye-level, where it could be easily observed.

15. A 1,000 mL graduated cylinder was used to collect and measure the flow through a single tube. A tight fitting funnel was placed over the cylinder to ensure that no water would enter other than through the single plastic tube. The funnel was slip-fitted over each collector tube one at a time. A digital timer was used for timing.
16. Several measurements were taken during the experiments to help determine the amount of lateral fluid distribution that was achieved using several different ceramic units. Table I summarizes the results of each experiment. The prior art ceramic unit results are shaded in gray in Table I and the results for the ceramic units made in accordance with the present invention are non-shaded and located on the right side of Table I.
17. The first measurement that was used to compare the lateral fluid distribution caused by the ceramic units was a determination of the number of cells that had liquid flow present within the collection grid. The larger the number of cells with flow, or active cells, indicates better lateral distribution because the feed stream is distributed across a larger area containing cells. The lower the flow rate within each cell also indicates better lateral distribution due to the dividing of the feed stream by the cells that distributes the feed stream better laterally. The results of this experiment are shown in Table I in the row labeled as "1. Total Number of Active Cells" and "2. % of Active Cells." The percentage of active cells is calculated by dividing the number of active cells by the total number of cells, 253. The best performing prior art ceramic unit was Product E. The best performing ceramic unit made in accordance with the present invention was Product F. Product F had 11% more active cells than the best performing prior art ceramic unit in this experiment, which represents a 46% improvement over the prior art.
18. The next experiment that was conducted determined an active area of the grid in which flow was determined and is labeled as the row "3. Area of Active Cells". The larger the Area of Active Cells, the better. The larger Area of Active Cells indicates better lateral distribution than a smaller Area of Active Cells. The Area of Active Cells was calculated by multiplying the horizontal distance of the active cells by the vertical distance of the active cells. Not every cell within the Area of Active Cells has flow. The ceramic unit made in accordance with the present invention labeled in Table I as Product F performed the best with the greatest Area of Active Cells being 180. The prior art ceramic unit labeled as Product C in

Table I performed the best with 143 active cells. It is believed that Product C would perform better than the Fulton Ceramic Unit because Product C has more openings than the Fulton Ceramic Unit. Product F made in accordance with the present invention performed approximately 26% better than the prior art Product C in this experiment.

19. Measurements were taken to determine the distance the flow was laterally distributed based upon the feed location. Product H, which is made in accordance with the present invention, performed the best compared to any of the tested ceramic units, with a total of ten cells with flow located greater than five cells away from the central feed location and three cells with flow located greater than six cells away from the central feed location. Out of the prior art ceramic units that were tested, the best performance was obtained by using Product C. Product C only had two cells with flow located greater than five cells away from the central feed location. No cells greater than six cells away from the central feed location had any flow in them in the prior art ceramic units. Product H performed at least five times better than Product C when determining the number of active cells greater than five cells away from the feed stream location. Product H performed at least three times better than Product C when determining the number of active cells greater than six cells away from the feed stream location.
20. Measurements were also taken of the flow rates within each cell. A lower flow rate is indicative of better lateral distribution, since the flow is distributed across a larger number of cells. The present invention embodiments with one central opening and surrounding elliptical openings consistently outperformed the prior art units tested.
21. The average flow rate per active cell was determined for each active cell. To determine this average flow rate, the total inlet feed flow rate was divided by the number of active cells. The lower the average flow rate, the better. A lower average flow rate per active cell indicates that the feed stream was distributed among a greater number of active cells. Product F performed the best with only 1.16% average of the flow rate. With respect to the prior art ceramic units, Product E performed the best with 1.69% average of the flow rate. The prior art with the closest structural similarity to the Fulton Ceramic Unit, Product C, had a 1.72% average of the flow rate. The present invention performed approximately 30% better than the best performing prior art ceramic units tested.

22. The maximum flow rate in a cell was also measured for all of the tested ceramic units. The maximum flow in a cell was determined by measuring the flow rates of each active cell and determining the highest flow rate of those cells. In this experiment, the lower the maximum flow rate, the better. The best performing ceramic unit tested was Product F with only a 4.46% maximum flow rate in any one cell. The best performing prior art ceramic unit was Product C with an 8.45% maximum flow rate in any one cell. The best embodiment of the present invention, Product F, performed approximately 47% better than the best performing prior art ceramic unit tested, Product C.

23. Measurements for the percentage of active cells with greater than 3% of total flow and greater than 5% of total flow were also taken. The percentage of active cells with greater than three and five percent of the total flow was determined by comparing the flow rates of the active cells with three and five percent of the total flow rate of the inlet feed stream respectively. With respect to the experiment measuring greater than 3% of total flow, the best performer in accordance with the present invention was Product H with only 8.33% of the cells having a flow rate greater than 3% of the total flow rate. The best performing prior art was Product C with 17.24% of the cells having a flow rate greater than 3% of the total flow rate. In this experiment, the lower the percentage of active cells with greater than 3% of total flow, the better. The present invention, Product H, performed approximately 52% better than the prior art ceramic units, Product C, in this experiment. With respect to the experiment measuring greater than 5% of total flow, the best performer in accordance with the present invention was Product H with 0% of the cells having a flow rate greater than 5% of the total flow rate. The best performing prior art was the Product E with 5.08% of the cells having a flow rate greater than 5% of the total flow rate. In this experiment, the lower the percentage of active cells with greater than 5% of total flow, the better. The present invention, Product C, performed significantly better than the prior art ceramic units, Product E, in this experiment also.

24. To the best of my knowledge and understanding, based upon experiments that I performed, lateral fluid distribution was improved in all performance indicators measured when using the ceramic units of the present invention compared with use of prior art ceramic units.

Product F performed the best consistently when compared with the consistently best performing prior art ceramic filter unit, Product C.

25. The attached Table I demonstrates the amount of lateral fluid distribution that was obtained by using the ceramics of the present invention and prior art ceramic units. As can be seen from the Table I, advantageous properties are associated with the use of the central opening with elliptical openings. The advantageous properties resulting from the use of elliptical openings are unexpected.
26. Crystaphase has enjoyed much commercial success from the sale of these ceramic units. Crystaphase began selling the ceramic units made in accordance with the present invention in 1998. Since then, Crystaphase has sold more than eight million dollars worth of units made in accordance with the present invention, which approximates 40,000 cubic feet of product being sold, which correlates to about 30% – 35% of the total market over the past six years. With so many units sold, the ceramic units should be deemed to have met an unfilled need in the industries in which these ceramic units have been sold.
27. I believe there is no motivation for one of ordinary skill in the field of ceramic filter units to utilize ceramic disc units containing a central circular opening and at least three elliptical openings in accordance with the present invention, at least without resorting to hindsight after viewing the present invention.
28. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Sec. 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the publication or any patent issued thereon.

Date

11/5/03

John N. Glover

TABLE I - SUMMARY OF COLD FLOW EXPERIMENT RESULTS

Shape	PRIOR ART					PRESENT INVENTION		
	Spheres		Cylindrical Openings			Elliptical Openings		
Product	A (3/4" Ceramic balls) 6"	B (3/4" Ceramic balls) 12"	C (5/8" TK-10) 6"	D (7/8" TK-10) 6"	E (5/8" Dypor 607) 6"	F (5/8" BG-1000) 6"	G (7/8" BG-1000) 6"	H (7/8" BG-1002) 6"
Top layer - Depth.								
Shape	Sphere	Sphere	Disc with 7 cylindrical openings	Disc with 7 cylindrical openings	Disc with one cylindrical opening and six flutes	Disc with four elliptical and one central circular openings	Disc with four elliptical and one central cylindrical openings	Elongated Disc with four elliptical and one central cylindrical openings
Void space	n/a	n/a	55%	55%	60%	60%	60%	63%
Bottom layer - Depth								
Size and Shape	3/4" Sphere ~39%	-	3/4" Sphere ~39%	3/4" Sphere ~39%	3/4" Sphere ~39%	3/4" Sphere ~39%	3/4" Sphere ~39%	3/4" Sphere ~39%
Void space	36	46	58	46	59	86	69	84
1. Total number of active cells	14.23%	18.18%	22.92%	18.18%	23.32%	33.99%	27.27%	33.20%
2. % of active cells	49	100	143	72	120	180	121	153
3. Area of Active Cells	0	0	2	0	1	4	2	10
4. Number of active cells greater than 5 cells distance from center	0	0	0	0	0	0	0	3
5. Number of active cells greater than 6 cells distance from center	2.78%	2.17%	1.72%	2.17%	1.69%	1.16%	1.45%	1.19%
6. Average Flow Rate per Active Cell	10.42%	7.03%	8.45%	10.39%	9.07%	4.46%	7.17%	9.74%
7. Maximum Flow Rate in a Cell	27.78%	23.91%	17.24%	26.09%	23.73%	10.47%	8.70%	8.33%
8. Percentage of active cells greater than 3% of total flow	25.00%	8.70%	5.17%	6.52%	5.03%	0.00%	7.25%	3.57%
9. Percentage of active cells greater than 5% of total flow								

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X. RELATED PROCEEDINGS APPENDIX

None.